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Choi et al.

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(54) **LIGHTING DEVICE**

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See application file for complete search history.

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(57) **ABSTRACT**

A lighting device according to one embodiment comprises: a housing having an opening; a half mirror member arranged in the opening; a first light source unit for emitting light at the half mirror member; a mirror member for re-reflecting light reflected by the half mirror member; a diffusion plate arranged between the first light source unit and the half mirror member; and a guide unit protruding from the lower surface of the housing, wherein the housing includes a first area and a second area formed by the guide unit, the first light source unit is arranged in the first area and the mirror member is arranged in the second area, and the diffusion plate can be supported by the guide unit. Therefore, the lighting device can implement various three-dimensional effects of an optical image according to a field of view by using the half mirror member and the mirror member during lighting.

15 Claims, 9 Drawing Sheets

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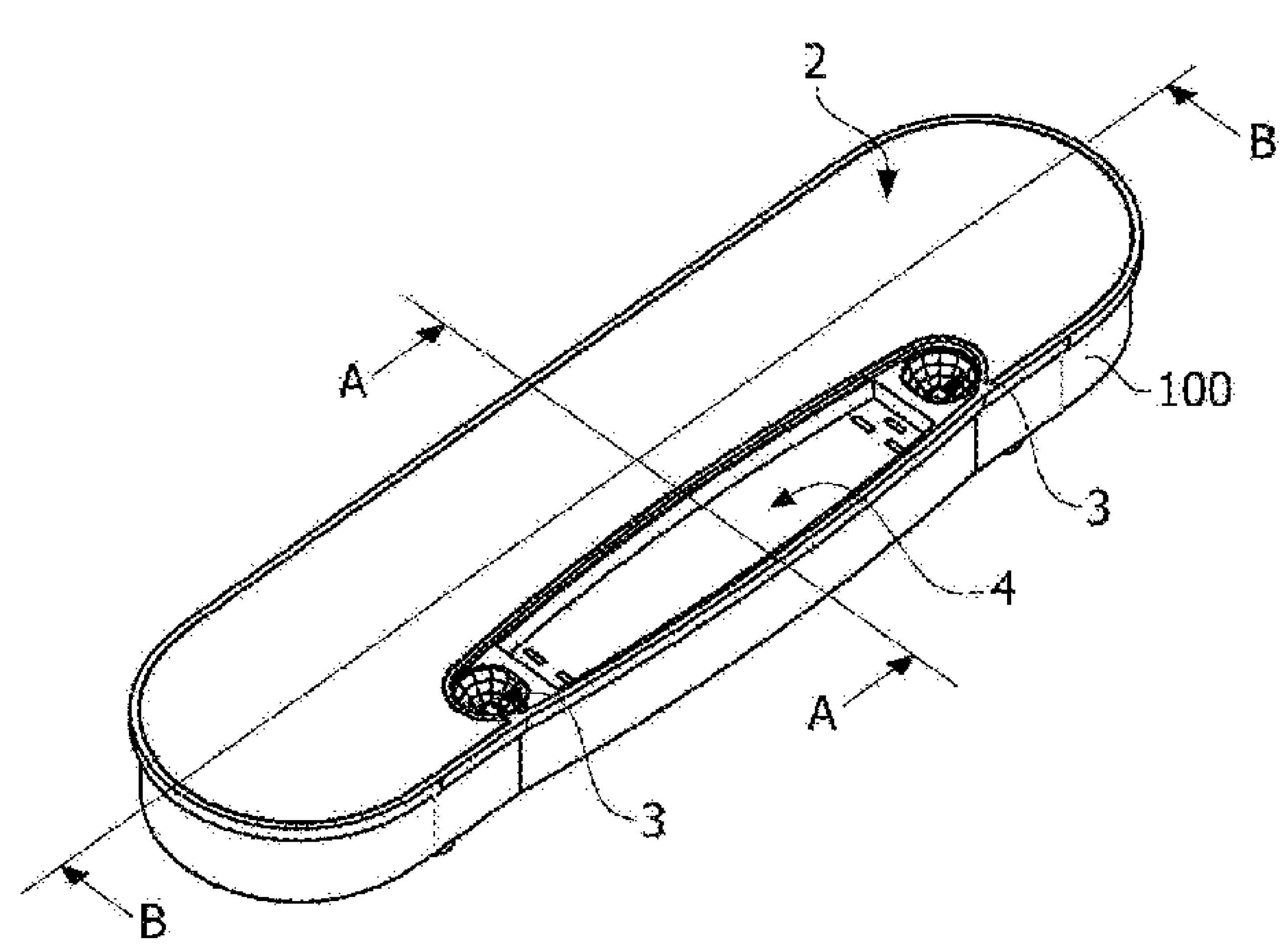

(51) **Int. Cl.**

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F21W 103/60	(2018.01)
F21W 103/10	(2018.01)
F21W 103/35	(2018.01)

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FIG. 1

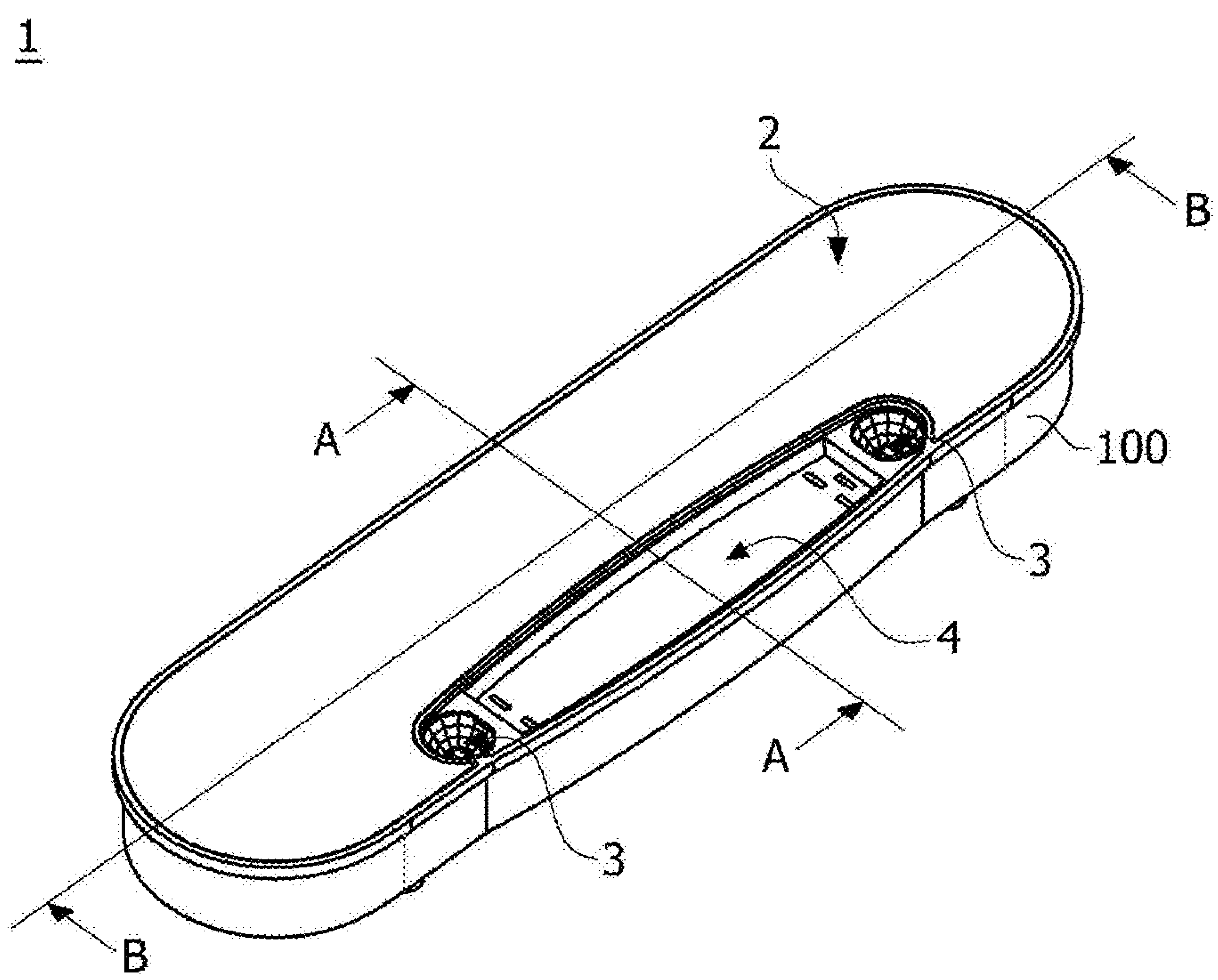


FIG. 2

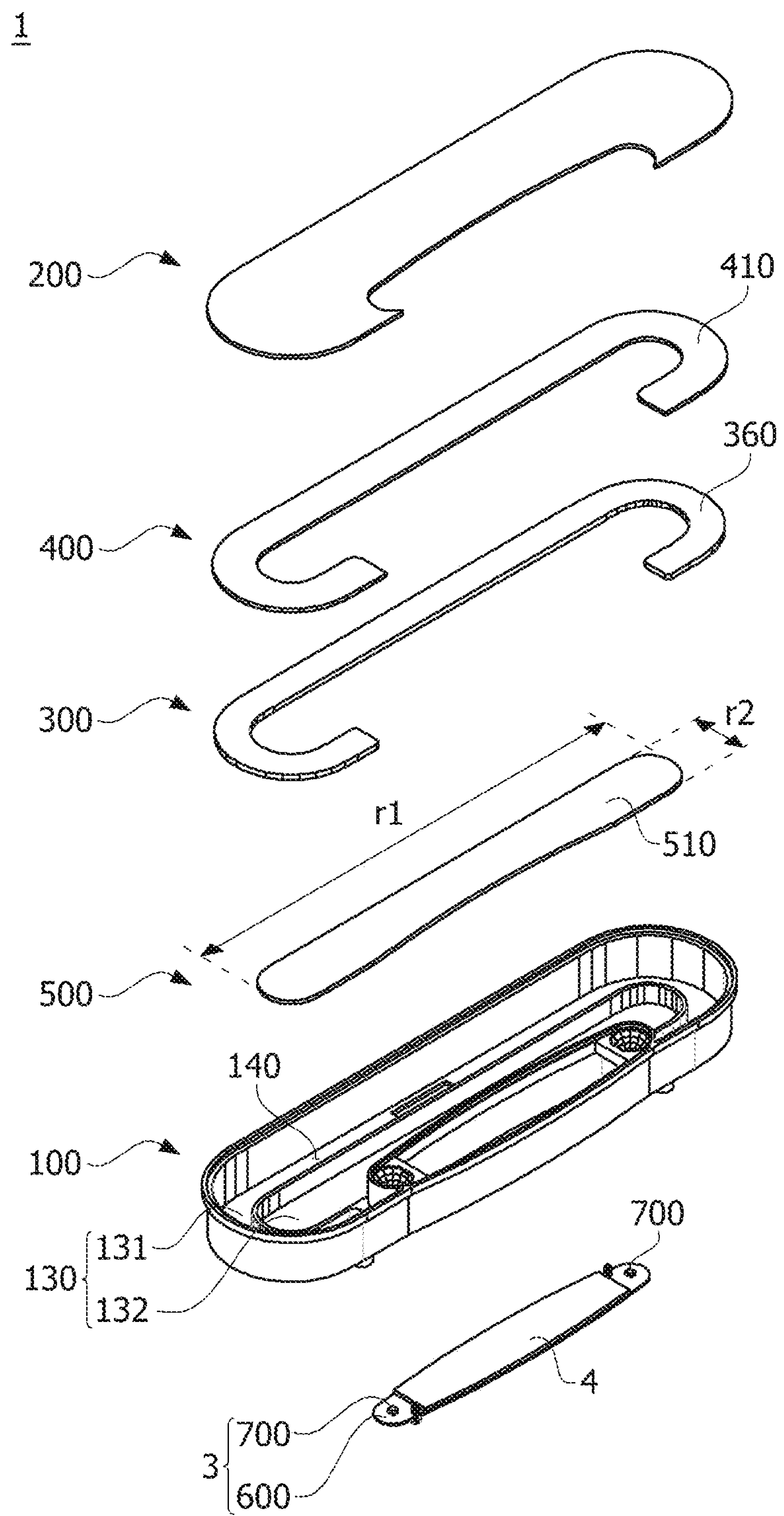

1
200
410
400
360
300
r2
r1
510
500
140
100
131
130
132
700
4
700
3
600

FIG. 3

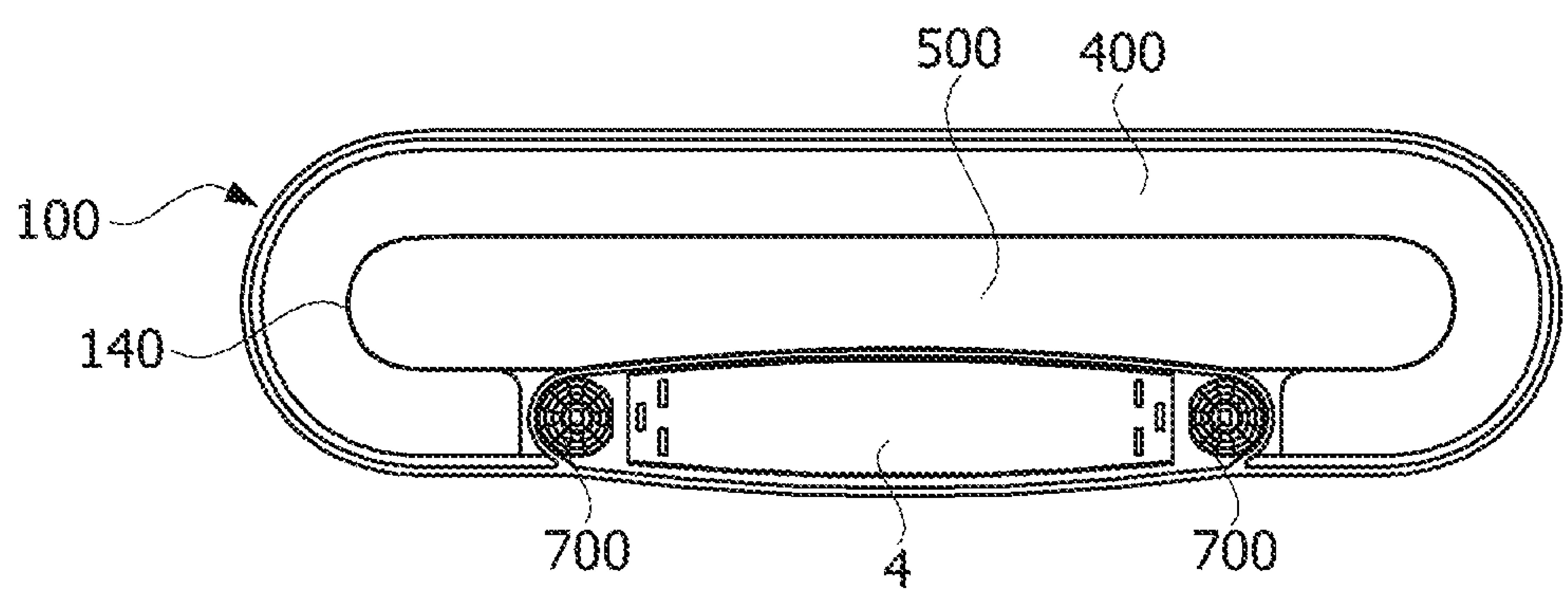


FIG. 4

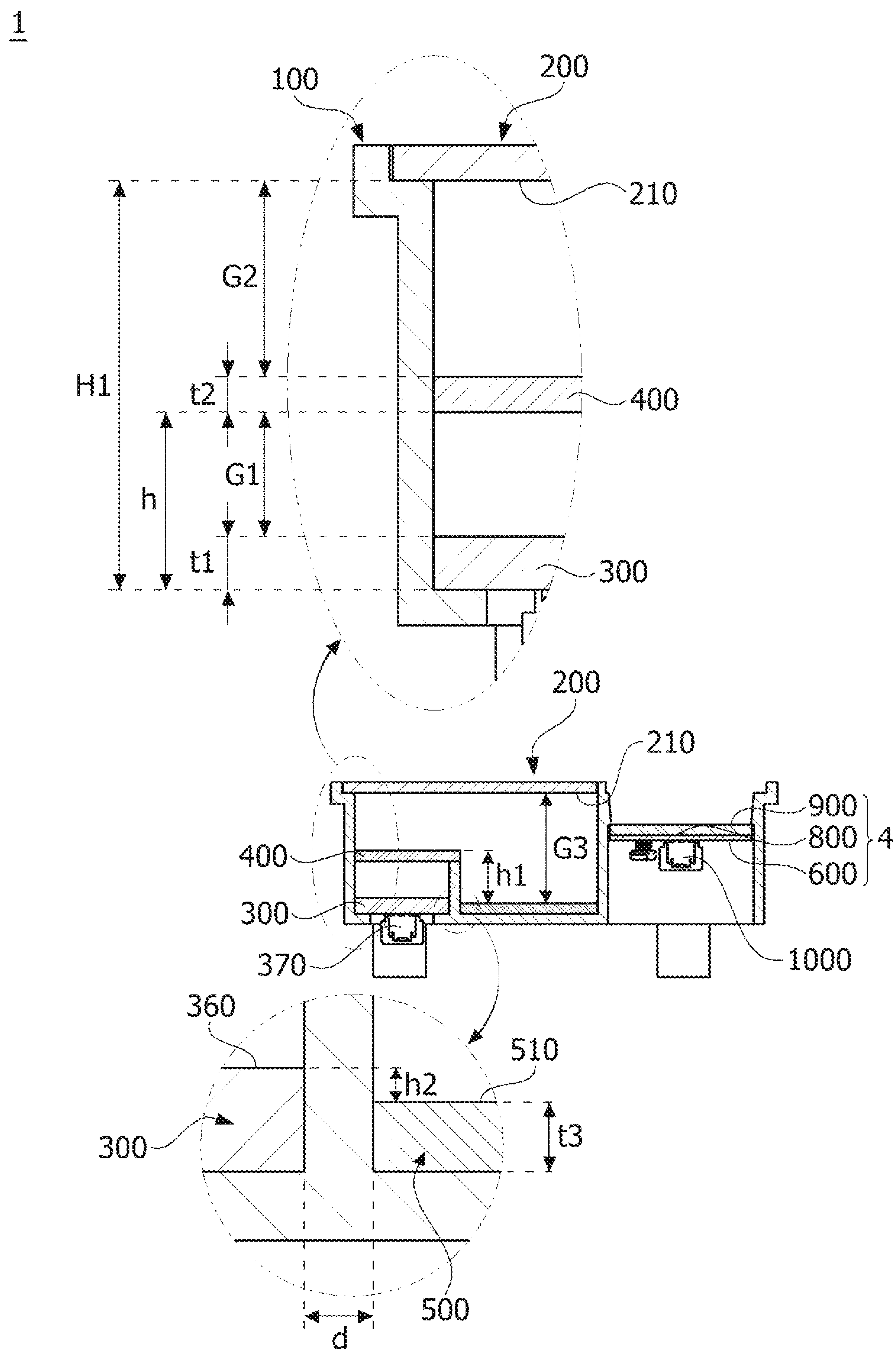

1
100
200
210
G2
H1
t2
400
h
G1
t1
300
200
210
900
800
4
600
G3
400
h1
300
370
1000
360
510
h2
t3
300
500
d

FIG. 5

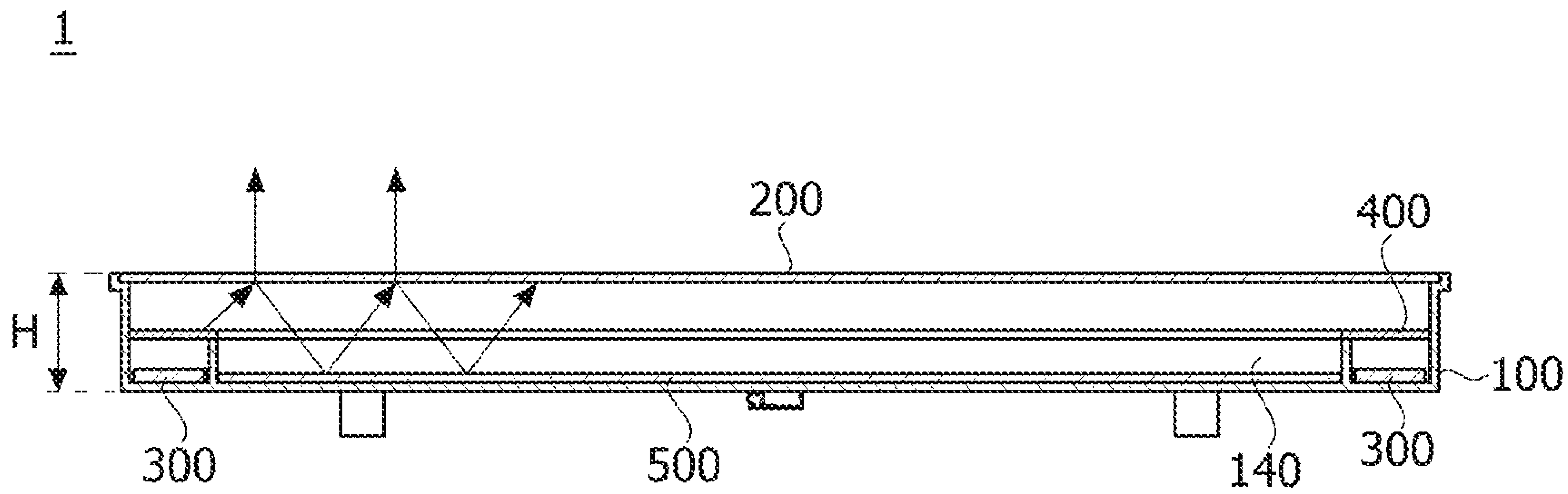

1
200
400
H
100
300
500
140
300

FIG. 6

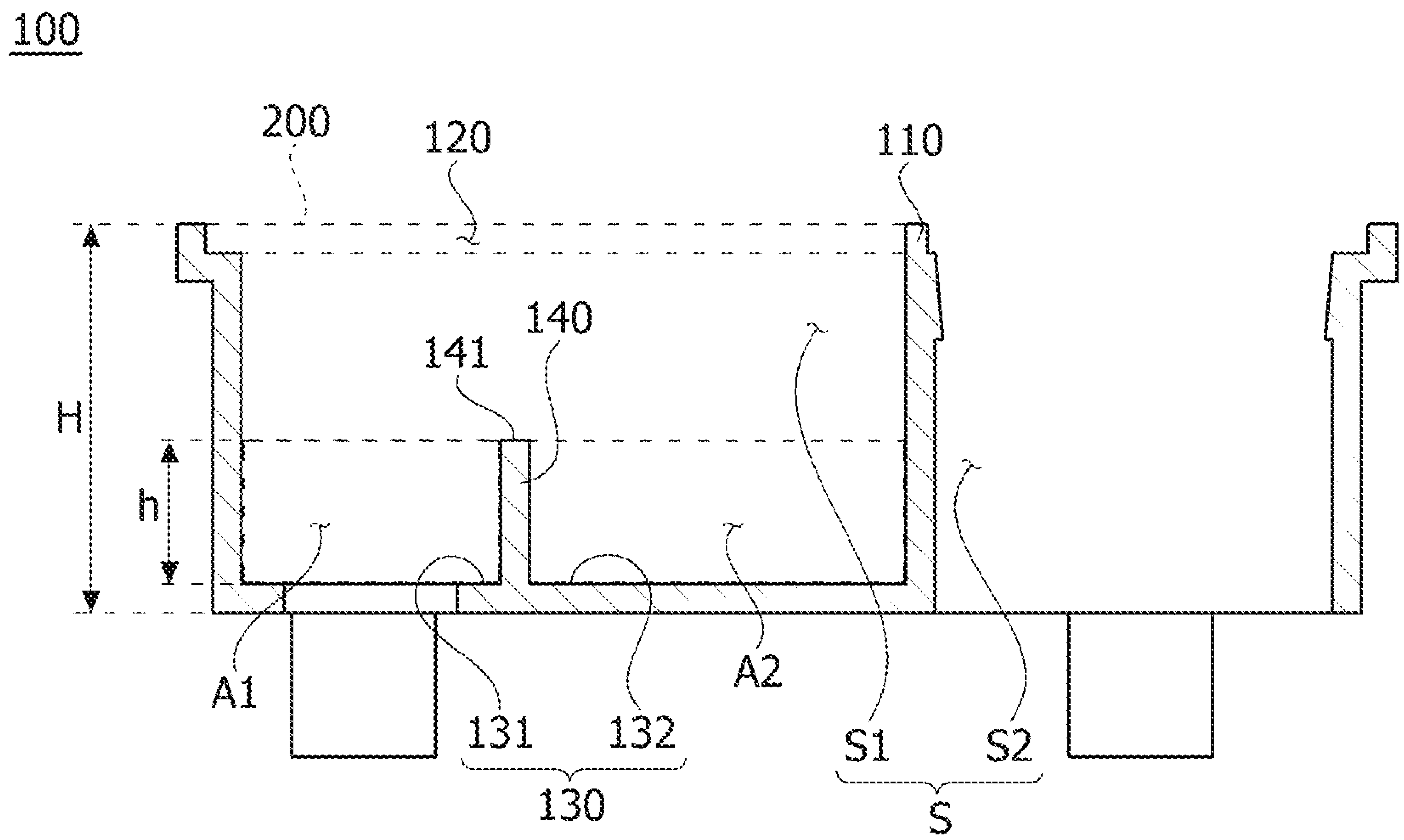

100
200
120
110
H
141
140
h
A1
131
132
130
A2
S1
S2
S

FIG. 7

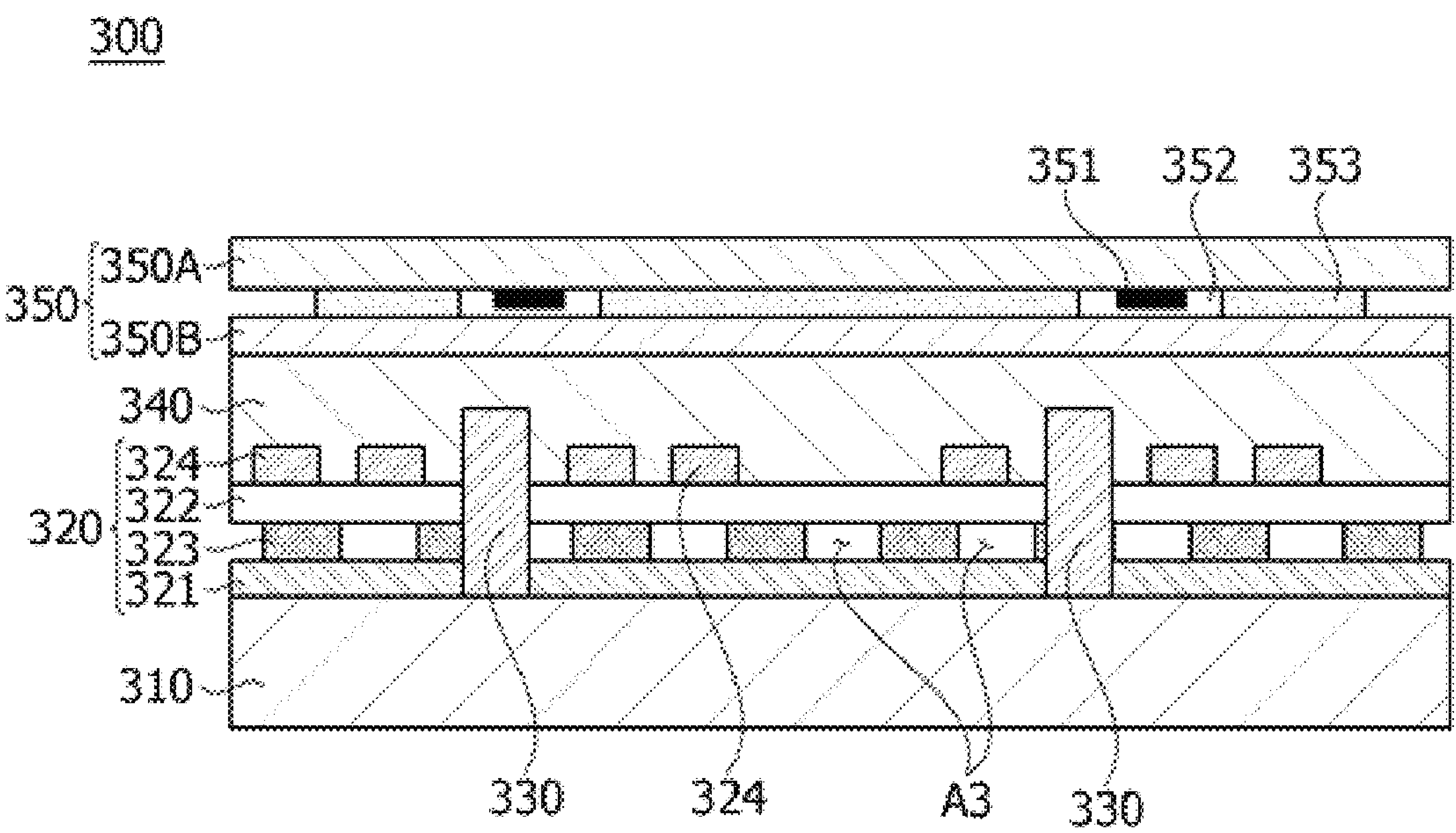

300
351
352
353
350A
350
350B
340
324
322
320
323
321
310
330
324
A3
330

FIG. 8

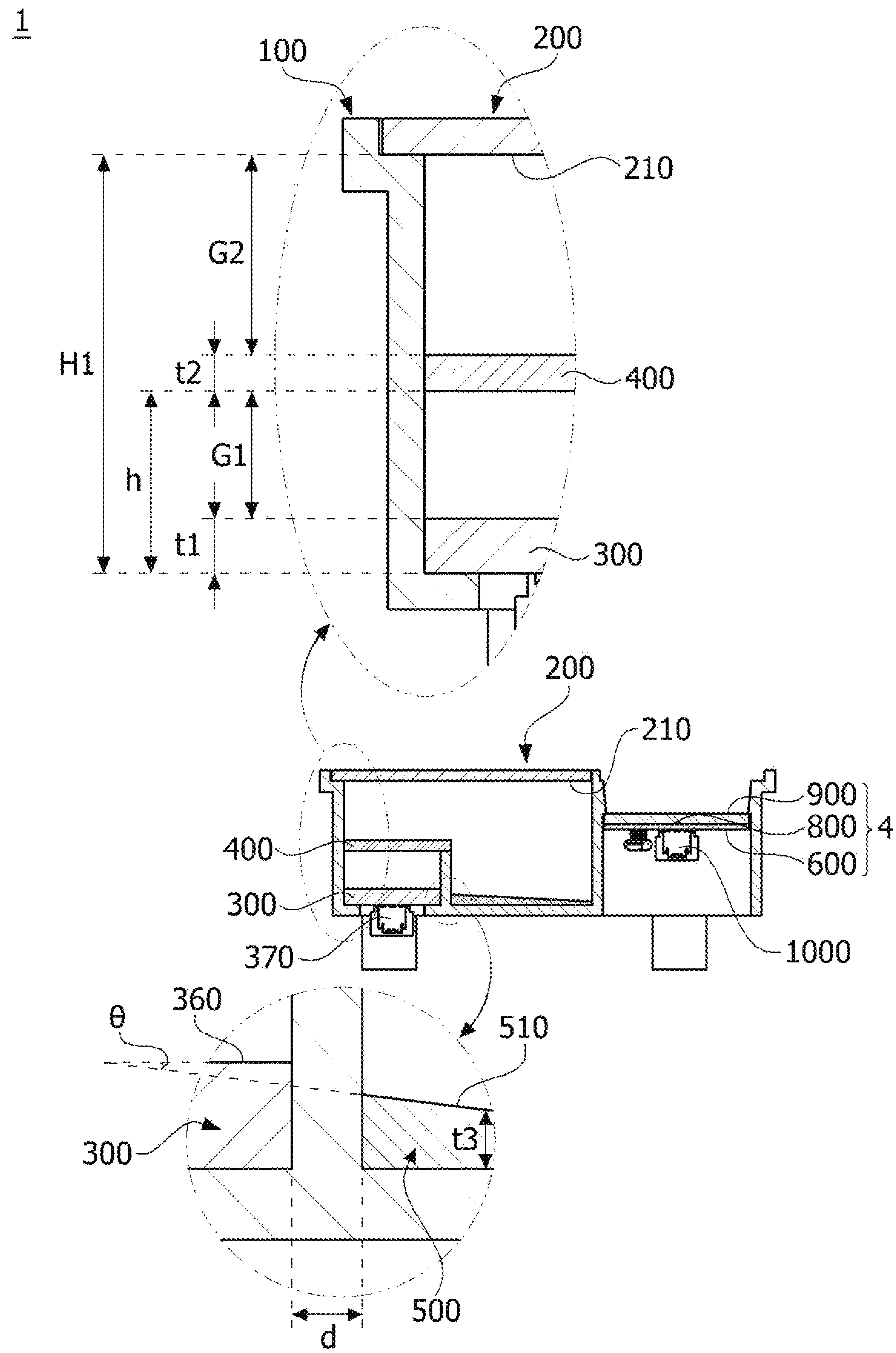
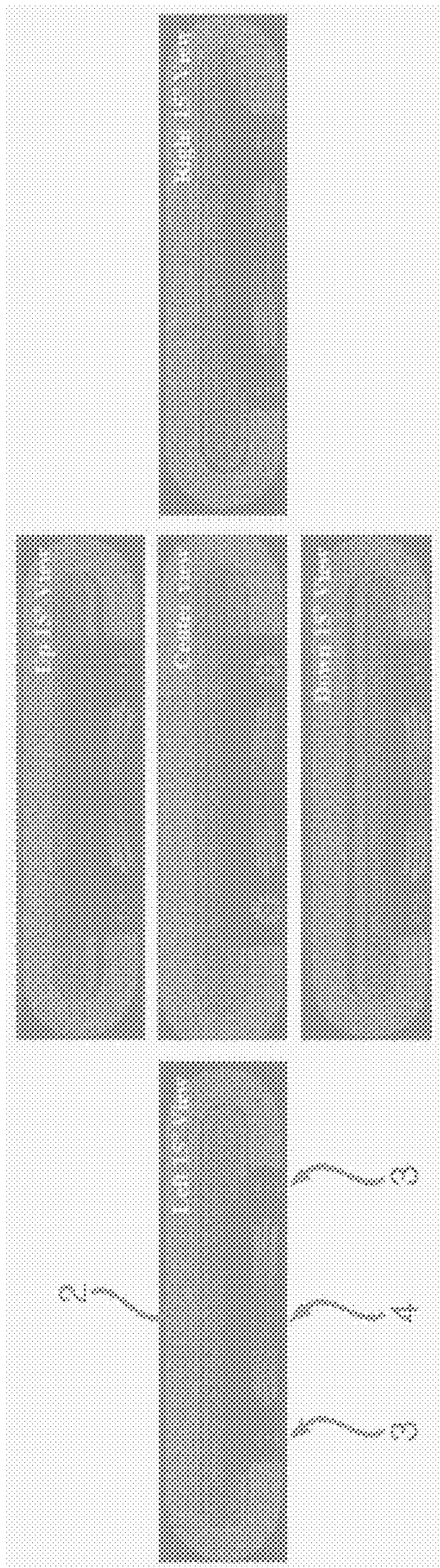

1
100
200
210
G2
H1
t2
400
G1
h
t1
300
200
210
900
800
4
600
400
300
370
1000
360
θ
510
300
t3
500
d

FIG. 9



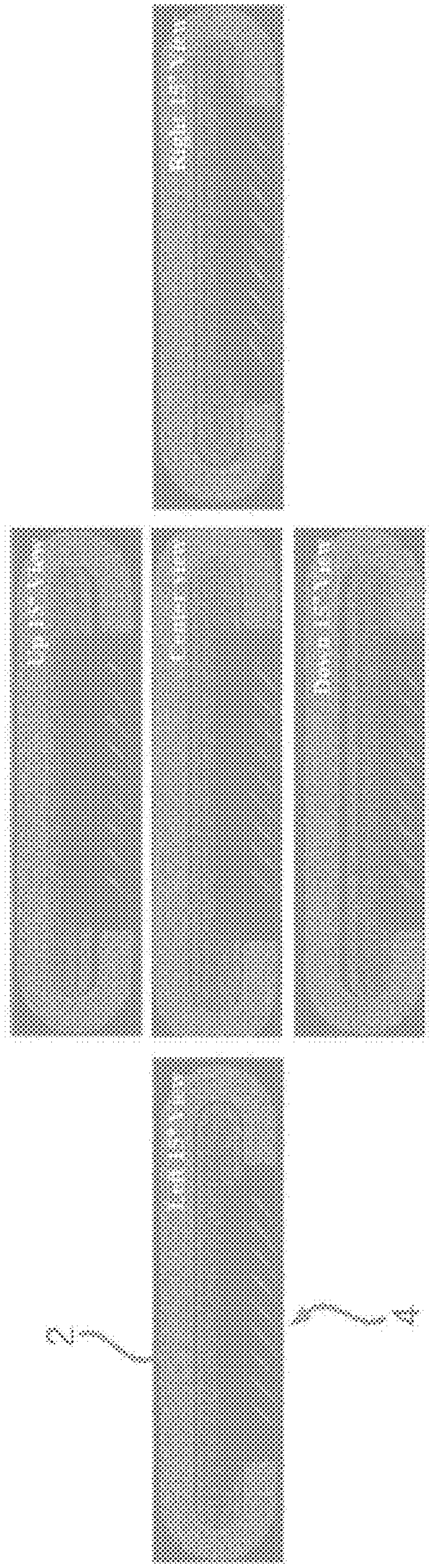


FIG. 10

LIGHTING DEVICE

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

This application is a U.S. National Stage Application under 35 U.S.C. § 371 of PCT Application No. PCT/KR2018/004226, filed Apr. 11, 2018, which claims priority to Korean Patent Application No. 10-2017-0051508, filed Apr. 21, 2017, whose entire disclosures are hereby incorporated by reference.

TECHNICAL FIELD

Embodiments relate to a lighting device which implements a three-dimensional light image.

BACKGROUND ART

Recently, a lighting device has been developed to have three-dimensional lighting formed from dots, lines, and planes.

The lighting device may be used for the purpose of increasing intensity of illumination of a limited place or for uniform light emitting efficiency. Furthermore, the lighting device may satisfy light distribution regulations by adjusting brightness and may be used as a vehicular lamp.

Here, a demand for implementing a variety of shapes or three-dimensional effect of the lighting device in consideration of design component has been increasing.

However, in a conventional vehicular lighting device, a three-dimensionally effective lighting device is implemented by arranging a plurality of light emitting diode (LED) light sources in a three-dimensional structure such as a step type structure installed along a curved surface of a vehicle and by reflecting light through a mirror formed on an inner surface of the three-dimensional structure.

As described above, since the three-dimensional structure and the plurality of LED light sources are arranged in the conventional vehicular lighting device to implement three-dimensional lighting, it is complicated to design and manufacture the conventional vehicular lighting device.

Also, in the conventional vehicular lighting device, since it is necessary to adjust light intensity or brightness required for a vehicle by covering a large light emitting area of the lighting device using an LED light source having a narrow radiation angle, it is necessary to use a large number of LED light sources. Accordingly, costs thereof increase.

For example, in the conventional vehicular lighting device, since three-dimensional lighting is implemented on the basis of the three-dimensional structure, in order to manufacture natural three-dimensional lighting, a complicated structure in which a plurality of LED lightings are densely arranged between the three-dimensional structures and a complicated control process of controlling brightness of the plurality of LED lightings to be gradually brighter or darker are necessary. However, such environments ultimately cause an increase in cost.

Also, corresponding to a lighting device size restricted by a consumer's demand is difficult for the conventional vehicular lighting device. Accordingly, due to restrictions in design, it is more difficult for the conventional vehicular lighting device to implement a variety of three-dimensional effects.

DISCLOSURE

Technical Problem

The present invention is directed to providing a lighting device capable of implementing an image like a mirror when the lighting device is turned off and of implementing a light image providing a variety of three-dimensional effects when the lighting device is turned on using a half mirror member and a mirror member.

The present invention is also directed to providing a lighting device capable of implementing a variety of three-dimensional light images having a sense of depth using a guide portion due to a limitation in design caused by a size of the lighting device.

The present invention is also directed to providing a lighting device capable of implementing a clear light image while improving space utilization by increasing light uniformity using the guide portion.

The present invention is also directed to providing a lighting device capable of implementing a three-dimensional light image having a sense of depth while simultaneously providing a clear light image while increasing space utilization using the guide portion using a half mirror member and a mirror member.

Aspects of the embodiment are not limited to the above-stated aspects and other unstated aspects can be clearly understood by those skilled in the art from the following description.

Technical Solution

One aspect of the present invention provides a lighting device including a housing with an opening formed therein, a half mirror member disposed in the opening, a first light source portion configured to emit light toward the half mirror member, a mirror member configured to reflect light reflected by the half mirror member, a diffusion plate disposed between the first light source portion and the half mirror member, and a guide portion protruding from a bottom surface of the housing. Here, the housing includes a first area and a second area which are formed by the guide portion. The first light source portion is disposed in the first area, and the mirror member is disposed in the second area. Also, the diffusion plate is supported by the guide portion.

Another aspect of the present invention provides a lighting device including a housing with an opening formed therein, a half mirror member disposed to cover the opening, a first light source portion disposed on a bottom surface of the housing and configured to emit light toward the half mirror member, a mirror member disposed on the bottom surface of the housing and configured to reflect light reflected by the half mirror member; a guide portion disposed to protrude between the first light source portion and the mirror member, and a diffusion plate disposed on an optical path between the first light source portion and the half mirror member. Here, the bottom surface of the housing may be divided into a first bottom surface and a second bottom surface by the guide portion formed to protrude from the bottom surface. Also, the first light source portion may be disposed on the first bottom surface, and the mirror member may be disposed on the second bottom surface.

The guide portion may be formed to protrude to a certain height h, and the first light source portion and the mirror member may be arranged to be spaced at a certain distance d apart by the guide portion.

A light emission surface of the first light source portion may be disposed to be spaced at a first gap G1 apart from the diffusion plate.

The first light source portion may be formed to have a certain thickness t1, and the first gap G1 may be adjusted according to the thickness t1 of the first light source portion.

The diffusion plate may be disposed to be spaced at a certain second gap G2 apart from a bottom surface of the half mirror member.

The diffusion plate may be formed to have a certain thickness t2, and the second gap G2 may be adjusted according to the thickness t2 of the diffusion plate.

The second gap G2 may be greater than the first gap G1.

A reflective surface of the mirror member may be disposed to be spaced at a certain third gap G3 apart from a bottom surface of the half mirror member.

The mirror member may be formed to have a certain thickness t3, and the third gap G3 may be adjusted according to the thickness t3 of the mirror member.

The reflective surface of the mirror member may be disposed to form a certain height difference h1 from a top surface of the diffusion plate while being disposed to be lower than the top surface of the diffusion plate.

The reflective surface of the mirror member may be disposed to form a certain height difference h2 from a light emission surface of the light source portion.

The reflective surface of the mirror member may be disposed to be inclined at a certain angle θ on the basis of the light emission surface of the light source portion.

The lighting device may further include a stop lamp portion disposed in the housing. Here, the stop lamp portion may include a second printed circuit board and second light sources disposed on the second printed circuit board, and the second light sources may be turned on by a brake of a vehicle being operated.

The lighting device may further include a third light source disposed on the second printed circuit board and a pattern member disposed on an optical path of the third light source. Here, the pattern member may modify a shape of light emitted from the third light source.

The lighting device may further include an image lamp portion disposed between the second light sources of the stop lamp portion.

Advantageous Effects

According to embodiments, a lighting device may implement an image like a mirror when the lighting device is turned off and implement a light image providing a variety of three-dimensional effects when the lighting device is turned on by using a half mirror member configured to transmit a part of surface-emitted light and to reflect another part thereof and a mirror member.

Also, the lighting device may implement an image modified according to a viewing angle by using the half mirror member and the mirror member.

Also, the lighting device may implement a three-dimensional light image having a sense of depth by using the half mirror member and the mirror member configured to reflect light reflected by the half mirror member. Here, the lighting device may improve space utilization even with a limitation caused by a size of the lighting device by providing a reference of design using a guide portion.

Accordingly, the lighting device may reduce an overall thickness of the lighting device and may implement a variety of three-dimensional light images.

Also, the lighting device may increase light uniformity of light emitted from a first light source portion using the guide portion. Accordingly, clarity of the three-dimensional light image may be secured.

DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of a lighting device according to an embodiment;

FIG. 2 is an exploded perspective view of the lighting device according to the embodiment;

FIG. 3 is a plan view of the lighting device according to the embodiment from which a half mirror member is removed;

FIG. 4 is a cross-sectional view of the lighting device according to the embodiment taken along line A-A;

FIG. 5 is a cross-sectional view of the lighting device according to the embodiment taken along line B-B;

FIG. 6 is a cross-sectional view of a housing shown in FIG. 4;

FIG. 7 is a view illustrating a first light source portion of the lighting device according to the embodiment;

FIG. 8 is a view illustrating another example of a mirror member disposed in the lighting device according to the embodiment;

FIG. 9 is a view illustrating turned-on light images of the lighting device according to the embodiment according to viewing angles; and

FIG. 10 is a view illustrating turned-on light images of a tail lamp portion and an image lamp portion of the lighting device according to the embodiment according to viewing angles.

MODES OF THE INVENTION

Although a variety of modifications and several embodiments of the present invention may be made, exemplary embodiments will be illustrated in the drawings and described. However, it should be understood that the present invention is not limited to the exemplary embodiments and includes all changes and equivalents or substitutes included in the concept and technical scope of the present invention.

The terms including ordinal numbers such as "second," "first," and the like may be used for describing a variety of components. However, the components are not limited by the terms. The terms are used only for distinguishing one component from another component. For example, without departing from the scope of the present invention, a second component may be referred to as a first component, and similarly, a first component may be referred to as a second component. The term "and/or" includes any and all combinations of one or a plurality of associated listed items.

When it is stated that one component is "connected" or "joined" to another component, it should be understood that the one component may be directly connected or joined to the other component but another component may be present therebetween. On the other hand, when it is described that one component is "directly connected" or "directly joined" to another component, it should be understood that no other component is present therebetween.

While the embodiments are described, when one component is described as being "on or under" another component, the two components may come into direct contact with each other or may come into indirect contact with each other with another component interposed therebetween. Also, the term "on or under" may include not only an upward direction but also a downward direction on the basis of one component.

Terms used herein are used merely for describing exemplary embodiments and are not intended to limit the present invention. Singular expressions, unless clearly defined otherwise in context, include plural expressions. Throughout the application, it should be understood that the terms "comprise," "have," and the like are used herein to specify the presence of stated features, numbers, steps, operations, elements, components or combinations thereof but do not preclude the presence or addition of one or more other features, numbers, steps, operations, elements, components, or combinations thereof.

Unless defined otherwise, the terms used herein including technical or scientific terms have the same meanings as those which are generally understood by one of ordinary skill in the art. Terms such as those defined in commonly used dictionaries should be construed as having meanings equal to contextual meanings of related art and should not be interpreted in an idealized or excessively formal sense unless defined otherwise herein.

Hereinafter, embodiments will be described in detail with reference to the attached drawings. Regardless of drawing's signs, equal or corresponding elements will be referred to as like reference numerals and an overlapped description thereof will be omitted.

A lighting device **1** according to an embodiment may be used in a vehicle lamp, a home-use lighting device, an industrial lighting device, an advertisement device installed indoor or outdoor, and the like.

When the lighting device **1** is used as a vehicle lighting device, it may be used in indoor lighting, a door scuff, a rear combination lamp, and the like of a vehicle.

Particularly, when the lighting device **1** is used as a rear combination lamp, the lighting device **1** may be used as a tail lamp while simultaneously further performing at least one of functions of a stop lamp and an image lamp.

Here, the tail lamp may inform a following vehicle of a location of a vehicle in a dark place. Also, the stop lamp and a brake of the vehicle work together such that it is possible to inform a following vehicle of a stall or speed-reduction state of the vehicle. Also, the image lamp may implement a variety of light images and increase a degree of freedom and aesthetics in design of the lighting device.

Referring to FIG. **1**, the lighting device **1** may include a tail lamp portion **2**, a stop lamp portion **3**, and an image lamp portion **4**. That is, the lighting device **1** may include only the tail lamp portion **2**, and at least one of the stop lamp portion **3** and the image lamp portion **4** may be further disposed.

Referring to FIGS. **1** to **5**, the lighting device **1** according to the embodiment may include a housing **100**, a half mirror member **200** disposed on one side of the housing **100**, a first light source portion **300**, a diffusion plate **400**, and a mirror member **500**. Here, the half mirror member **200** and the diffusion plate **400** may be arranged on a light emission line of the first light source portion **300**.

Accordingly, the lighting device **1** implements the tail lamp portion **2** using the housing **100**, the half mirror member **200**, the first light source portion **300**, the diffusion plate **400**, and the mirror member **500** so as to perform a function of a tail lamp.

Here, using the half mirror member **200** and the mirror member **500**, the tail lamp portion **2** of the lighting device **1** may implement a mirror image such as a mirror when a lamp is turned off and may implement an emission image of light which provides a variety of three-dimensional effects when a lamp is turned on. Here, "three-dimensional effect" may be defined as implementing a light emission image (hereinafter, referred to as "light image") implemented by the lighting device **1** having a certain sense of depth (perspective) or a sense of volume.

Also, the lighting device **1** may implement a light image with a three-dimensional effect varying according to a viewing angle using the half mirror member **200** and the mirror member **500**.

Referring to FIG. **6**, the housing **100** may be formed to have a cylindrical shape having a preset height H. Here, the height H may be determined by a consumer's demand. Accordingly, the lighting device **1** may have a designing limitation with respect to a size.

The housing **100** may have a space S formed therein. Also, the space S may include a first space S**1** and a second space S**2** divided by a wall **110**. As shown in FIG. **6**, an opening **120** may be formed in a top of the first space S**1**.

Also, a guide portion **140** may be disposed in the housing **100**.

Accordingly, a first area A**1** and a second area A**2** distinguished by the guide portion **140** may be formed in the housing **100**. The first light source portion **300** may be disposed in the first area A**1**, and the mirror member **500** may be disposed in the second area A**2**.

In detail, the guide portion **140** may be disposed on a bottom surface **130** of the housing to protrude therefrom. Here, the guide portion **140** may be integrated with the bottom surface **130** but is not limited thereto.

For example, the guide portion **140** may be formed to distinguish the bottom surface **130** into a first bottom surface **131** and a second bottom surface **132**. Also, the first light source portion **300** may be disposed on the first bottom surface **131**, and the mirror member **500** may be disposed on the second bottom surface **132**.

Here, the guide portion **140** guides the first light source portion **300** and the mirror member **500** to be arranged at preset positions. Accordingly, the first light source portion **300** and the mirror member **500** may be arranged by the guide portion **140** to be spaced apart.

That is, the guide portion **140** may be disposed between the first light source portion **300** and the mirror member **500** such that the first light source portion **300** and the mirror member **500** may be arranged to be spaced at a certain separation distance d apart. Here, the separation distance d may be adjusted by a width of the guide portion **140**. Here, as shown in FIG. **3**, the guide portion **140** may be disposed to surround an inner surface of the first light source portion **300**. Also, the guide portion **140** may be disposed to surround one side surface of the mirror member **500**.

Meanwhile, the guide portion **140** may be formed on the bottom surface **130** of the housing **100** to protrude therefrom to a certain height h. Here, a top end surface **141** of the guide portion **140** may be disposed to be spaced at a certain distance apart from a bottom surface **210** of the half mirror member **200**.

Also, the guide portion **140** formed to have the certain height h may guide light emitted from the first light source portion **300** toward the half mirror member **200** at the certain height h. Accordingly, the guide portion **140** may prevent the light emitted from the first light source portion **300** from being directly emitted toward the mirror member **500** and may provide an emission direction of the light so as to minimize optical interference with respect to light re-reflected by the mirror member **500**.

Also, since the guide portion **140** prevents the light emitted from the first light source portion **300** from being scattered within the preset height h, light uniformity may be improved. Accordingly, a distinct light image may be implemented on the half mirror member **200** by the light emitting from the first light source portion **300** and directly penetrating through the half mirror member **200**. In addition, since the distinct light image generates a difference in brightness from the light image reflected by the mirror member **500** and formed on the half mirror member **200**, a sense of depth of a three-dimensional light image may be increased.

The half mirror member **200** may be disposed to cover the opening **120**.

The half mirror member **200**, as shown in FIG. **5**, may transmit a part of light incident on the half mirror member **200** and may reflect another part. Also, the half mirror member **200**, as shown in FIG. **2**, may have a plate shape.

That is, the light emitted from the first light source portion **300** may be emitted outward through the opening **120**. Here, the half mirror member **200** is disposed in the opening **120**. Accordingly, the half mirror member **200** transmits a part of the light emitted from the first light source portion **300** and reflects another part. Also, since the reflected light is reflected by the mirror member **500**, a three-dimensionally effective light image may be implemented on the half mirror member **200**.

The half mirror member **200** may have a structure in which a metal layer is vapor-deposited on a substrate. Here, the substrate may be a variety of synthetic resin films, and the metal layer may include a metal material capable of being vapor-deposited such as Ni, Cr, Al, Ti, and the like. Accordingly, the half mirror member **200** may implement a further thickness-decreased structure. In this case, vapor deposition of the metal layer may be performed on one surface or both surfaces of the substrate, and a letter or picture having a particular shape may be added.

The first light source portion **300** emits light toward the half mirror member **200**. Here, the first light source portion **300** may implement surface emission. That is, the first light source portion **300** may be provided as a surface light source.

As shown in FIGS. **2** and **3**, the first light source portion **300** may be formed to have a C shape but is not limited thereto and may be modified into a variety of shapes in consideration of a degree of freedom in design and a light image of the lighting device **1**. However, when the first light source portion **300** is formed having a C shape, since the mirror member **500** may be disposed thereinside, as shown in FIGS. **9** and **10**, the light image may be implemented to have a sense of depth increasing in a direction toward the inside.

Meanwhile, the first light source portion **300** disposed on the first bottom surface **131** may be formed to have a certain thickness t**1**. Here, the thickness t**1** of the first light source portion **300** may be changed in design in consideration of a three-dimensional effect of the light image.

As shown in FIG. **4**, a light emission surface **360** of the first light source portion **300** may be disposed to be spaced at a first gap G**1** apart from the diffusion plate **400**. Here, the light emission surface **360** of the first light source portion **300** may be disposed lower than a top end surface **141** of the guide portion **140**.

Accordingly, an air gap may be formed between the first light source portion **300** and the diffusion plate **400**. Since the air gap has a difference in a refractive index from that of the first light source portion **300**, light uniformity may be improved.

Accordingly, the first gap G**1** may improve light uniformity.

Here, the top end surface **141** of the guide portion **140** may be formed to be inclined at a certain angle.

Meanwhile, the first gap G**1** and the thickness t**1** of the first light source portion **300** may function as factors capable of adjusting the light uniformity. For example, the first gap G**1** may be adjusted according to the thickness t**1** of the first light source portion **300**.

As shown in FIG. **4**, since a sum of the first gap G**1** and the thickness t**1** of the first light source portion **300** is equal to the height h of the guide portion **140**, the light uniformity may be improved as the height h of the guide portion **140** increases. However, since the top end surface **141** of the guide portion **140** may be disposed on a path of light reflected by the half mirror member **200**, the height h of the guide portion **140** may preferably be in a range from 7 to 10 mm based on the bottom surface **130**. Here, a height H**1** from the bottom surface **130** to a bottom surface **210** of the half mirror member **200** may be in a range from 14 to 32 mm.

Referring to FIG. **7**, the first light source portion **300** may include a first printed circuit board **310**, a reflection unit **320**, a plurality of light emitting diodes (LED) light sources **330**, a resin layer **340**, and an optical pattern layer **350**.

The first light source portion **300** includes the plurality of LED light sources **330** formed on the first printed circuit board **310**. The reflection unit **320**, which is laminated on the first printed circuit board **310** while being penetrated by the LED light sources **330**, is included on a top surface of the first printed circuit board **310**.

Particularly, in this case, an air area A**3**, in which air is disposed, is provided in the reflection unit **320**. The air area A**3** maximizes brightness by increasing reflection efficiency of light emitted from the light source **130**.

For example, the reflection unit **320** may include a first reflection film **321** pressed against a surface of the first printed circuit board **310** and a second reflection film **322** having a transparent material and spaced apart from the first reflection film **321** to form the air area A**3**. The first and second reflection films **321** and **322** are laminated on the first printed circuit board **310**, and the LED light sources **330** pass through holes formed in the reflection films **321** and **322** and protrude outside the reflection films **321** and **322**.

It is possible to form the air area A**3** in a structure in which the first and second reflection films **321** and **322** are integrally pressed together without using an additional member such as an adhesive and the like. In addition, as shown in FIG. **7**, it is possible to implement the first and second reflection films **321** and **322** to be spaced apart from each other so as to implement the air area A**3**, which accommodates air, using spacing members **323** such as additional adhesive members and the like.

In this case, a reflective material reflecting light, for example, a film, on which a metal layer such as Ag and the like is formed, may be used as the first reflection film **321**. As the second reflection film **322**, it is preferable to use a transparent film such that light emitted from the LED is transferred to and reflected by a surface of the first reflection film **321**. Particularly, in addition to light emitted from the light source **330** being transmitted through the first reflection film **321** and reflected by the second reflection film **322**, a reflection pattern **324** may be provided by being white-printed on a surface of the second reflection film **322** such that dispersion of light may be further promoted to improve brightness.

The reflection pattern **324** provided to sharply improve reflection efficiency of light may be printed using a reflection ink including any one of TiO_2, $CaCO_3$, $BaSO_4$, Al_2O_3, Silicon, and PS.

Particularly, as the light source **330**, a variety of types of light sources may be applied, and preferably, side-emissive LEDs may be used. In this case, the reflection pattern **324** may preferably be formed in a light emission direction of the LED light source and, particularly, may be disposed such that pattern density may increase in a direction away from the emission direction of the LED light source. Accordingly, when the side-emissive LEDs are used, there is an advantage of significantly reducing the number of light sources.

The resin layer **340** is laminated in a structure surrounding a periphery of the LED light source **330** so as to perform a function of dispersing light of the light source which is emitted in a lateral direction. That is, the resin layer **340** may perform a function of a light-guiding plate.

As the resin layer **340**, any resins capable of basically diffusing light are usable. For example, as a main material of the resin layer **340**, a resin using a urethane acrylate oligomer as a main row material may be used. For example, a mixture formed by mixing a urethane acrylate oligomer, which is a synthetic oligomer, with a polyacryline polymer type may be used. Here, a monomer, in which isobornyl acrylate (IBOA) which is a low-boiling point and diluent type reactive monomer, hydroxylpropyl acrylate (HPA), 2-hydroxyethyl acrylate (2-HEA), and the like are mixed, may be further included. As an additive, a light initiator (that is, hydroxycyclohexyl, phenyl-ketone, and the like), an antioxidant, or the like may be added thereto.

In addition, the resin layer **340** may include beads to increase diffusion and reflection of light. Accordingly, light emitted from the light sources **330** in a lateral direction may be diffused and reflected by the resin layer **340** and the beads so as to travel upward.

This may further promote a reflection function in addition to the reflection unit **320**. Accordingly, the presence of the resin layer **340** may not only innovatively reduce a thickness of a conventional light-guiding plate so as to implement a size reduction of an entirety of a product but also has a flexible material so as to provide versatility to be applicable to a flexible display.

The optical pattern layer **350** may be disposed above the resin layer **340**. Also, the optical pattern layer **350** may include an optical pattern **351**.

The optical pattern layer **350** may include an adhesive pattern layer **353** which forms a second air area **352** surrounding a peripheral part of the optical pattern **351**.

The adhesive pattern layer **353** may be formed by forming a separate space (the second air area) on a periphery of the optical pattern **351** and applying an adhesive material to other parts.

As shown in FIG. **7**, in an arrangement relation between the optical pattern layer **350** and the adhesive pattern layer **353**, the optical pattern layer **350** may include a first substrate **350**A and a second substrate **350**B with the optical pattern **351** therebetween. Here, the adhesive pattern layer **353** is applied to other parts other than the second air area **352** which surrounds the peripheral part of the optical pattern **351** so as to allow the first substrate **350**A and the second substrate **350**B to adhere to each other.

Here, the optical pattern **351** may be formed as a light-shading pattern formed to prevent the light emitted from the LED light source **330** from being concentrated. To this end, it is necessary to align the optical pattern **351** with the LED light sources **330**. Also, after the alignment, the adhesion is performed using an adhesive for providing a fixing force.

Meanwhile, as the first substrate **350**A and the second substrate **350**B, a substrate formed of a material having excellent light transmittance may be used, and for example, PET may be used. In this case, the optical pattern **351** disposed between the first substrate **350**A and the second substrate **350**B may basically perform a function of preventing the light emitted from the LED light source from being concentrated and may be implemented by performing light-shading printing on any one of the first substrate **350**A and the second substrate **350**B. Also, the adhesive pattern layer **353** is an adhesive layer formed by applying an adhesive material having a structure surrounding a peripheral part of the light-shading pattern and may implement alignment by allowing the two substrates to adhere to each other. Here, the adhesive layer may be formed using thermosetting PSA, a thermosetting adhesive, an ultraviolet (UV)-thermosetting PSA type material.

Here, a top surface of the optical pattern layer **350** may be provided as the light emission surface **360**.

Also, a first connector **370** may be disposed in the first light source portion **300** to apply power thereto. As shown in FIG. **4**, the first connector **370** may be disposed below the first light source portion **300**.

Accordingly, a mirror image such as that of a mirror may be implemented by the half mirror member **200** when the light source is not turned on, and a three-dimensionally effective light image may be formed on the half mirror member **200** when the light source is turned on.

The diffusion plate **400** may improve light uniformity of the light emitted from the first light source portion **300**. Also, the diffusion plate **400** may diffuse or condense the light emitted from the first light source portion **300**.

The diffusion plate **400** may be disposed on an optical path between the half mirror member **200** and the first light source portion **300**. Accordingly, the light emitted from the first light source portion **300** passes through the diffusion plate **400** and is emitted toward the half mirror member **200**.

As shown in FIG. **4**, one side of the diffusion plate **400** may be supported by the guide portion **140**. Accordingly, depending on the height h of the guide portion **140**, light uniformity of light incident on the diffusion plate **400** may be adjusted.

Meanwhile, the diffusion plate **400** may be formed to have a certain thickness t2. Here, the diffusion plate **400** may be disposed to be spaced at a second gap G**2** apart from the bottom surface **210** of the half mirror member **200**.

Accordingly, air gaps may be formed above and below the diffusion plate **400** between the half mirror member **200** and the first light source portion **300**. As described above, the air gaps may improve light uniformity.

Meanwhile, the second gap G**2** is intimately associated with a light image implemented on the half mirror member **200**. Here, when the height H of the housing **100** is determined, the height h of the guide portion **140** and the thickness t2 of the diffusion plate **400** function as significant factors which determine the second gap G**2**.

As shown in FIGS. **9** and **10**, the second gap G**2** may form a dark part in the light image implemented on the half mirror member **200**.

Accordingly, a size of the dark part may be adjusted by the second gap G**2**. Also, the dark part may vivify the light image formed on the half mirror member **200** by a part of light emitted from the diffusion plate **400** which is directly transmitted through the half mirror member **200**.

Meanwhile, the second gap G**2** may be formed to be greater than the first gap G**1**. Accordingly, the lighting device **1** may provide definition of a light image.

The mirror member **500** may implement a three-dimensionally effective light image by re-reflecting light reflected by the half mirror member **200** toward the half mirror member **200**.

As shown in FIG. **2**, the mirror member **500** may be formed to have an elliptical shape in which a length r**1** of one side is longer than a length r**2** of the other side. That is, the mirror member **500** may be formed to have a shape fitting inside the guide portion **140**.

The mirror member **500** may be disposed on the second bottom surface **132** and may be formed of a material having high reflection efficiency.

For example, the mirror member **500** may include a reflective material having a self-reflective property.

Also, the mirror member **500** may be implemented as a structure formed of an additional material and coated with a reflective material on a surface thereof.

The reflective material may be implemented by coating a surface of a metal or a synthetic resin material with a metal material layer having an excellent reflection property such as Ag and the like or a reflective material layer such as TiO2, CaCo3, BaSO4, Al2O3, silicon, PS, and the like. Additionally, it is possible to implement a synthetic resin layer which is coated with or includes titanium oxide, aluminum oxide, zinc oxide, lead carbonate, barium sulfate, or calcium carbonate. In addition, it is possible to use any one material of Al, PC, PP, ABS, and PBT which have self-reflective properties.

In addition, as another example, the reflective material may be formed as a film type and may include a synthetic resin containing a white pigment being dispersed therein to implement a property of promoting a reflection property of light and dispersion of light. For example, as the white pigment, titanium oxide, aluminum oxide, zinc oxide, lead carbonate, barium sulfate, calcium carbonate, and the like may be used. As the synthetic resin, polyethylene terephthalate (PET), polyethylene naphthalate (PEN), acrylic resin, polycarbonate, polystyrene, polyolefin, cellulose acetate, weatherproof vinyl chloride, and the like may be used but the present invention is not limited thereto.

The mirror member **500** may be formed to have a certain thickness t**3**. Here, the mirror member **500** may be disposed to be spaced at a third gap G**3** apart from the bottom surface **210** of the half mirror member **200**.

A three-dimensional effect of the light image may depend on a movement distance of light in the first space S**1**. Here, the movement distance of the light may be adjusted by the second gap G**2** and the third gap G**3**. Also, the third gap G**3** may be adjusted by the thickness t**3** of the mirror member **500**.

Accordingly, a reflective surface **510** of the mirror member **500** may be disposed to form a certain height difference h**1** from a top surface **410** of the diffusion plate **400**. Preferably, the reflective surface **510** of the mirror member **500** may be disposed to be lower than the top surface **410** of the diffusion plate **400**. Accordingly, light uniformity may be secured while a sense of depth of the light image is further improved.

Here, a reflective surface **510** of the mirror member **500** may be disposed to form a certain height difference h**2** from the light emission surface **360** of the first light source portion **300**.

As shown in FIG. **4**, the reflective surface **510** of the mirror member **500** may be disposed to be lower than the light emission surface **360** of the first light source portion **300**. Accordingly, the sense of depth of the light image may be further improved.

As shown in FIG. **8**, the reflective surface **510** may be disposed to be inclined at a certain angle θ on the basis of the light emission surface **360** of the first light source portion **300**. That is, the mirror member **500** may be formed such that the thickness t**3** increases increasingly from one side toward the other side of the mirror member **500**.

Accordingly, a shape of the light image may be adjusted by the angle θ of the reflective surface **510**.

In comparison to an arrangement of the first light source portion **300** and the mirror member **500** in a horizontal structure (refer to FIG. **4**), the reflective surface **510** disposed to be inclined at the certain angle θ as shown in FIG. **8** may adjust an incident angle of light incident on the reflective surface **510**. Accordingly, a light image having a three-dimensional effect may be diversely modified.

The reflective surface **510** of the mirror member **500** may be exemplarily formed to have the inclined angle θ but is not limited thereto. For example, in consideration of the light image, the reflective surface **510** may be provided as a concave mirror, a convex mirror, or the like.

The stop lamp portion **3** of the lighting device **1** may be disposed in the second space S**2**. For example, the stop lamp portion **3** may be disposed inside the tail lamp portion **2**. Here, the stop lamp portion **3** may emit light in the same direction as that of light emitted from the tail lamp portion **2**.

The stop lamp portion **3** may include a second printed circuit board **600** and a second light source **700** disposed on the second printed circuit board **600**. Also, the second light source **700** and a brake (not shown) of a vehicle may work together. Here, the second printed circuit board **600** may be formed of a flexible material.

Accordingly, as shown in FIG. **9**, the stop lamp portion **3** is turned on when the brake operates such that a stall or speed reduction state of the vehicle may be recognized by a driver of a following vehicle thereof.

Accordingly, the lighting device **1** may further perform a function of a stop lamp.

The image lamp portion **4** of the lighting device **1** may be disposed in the second space S**2**. Here, the image lamp portion **4** may emit light in the same direction as that of light emitted from the tail lamp portion **2**.

As shown in FIG. **1**, the image lamp portion **4** of the lighting device **1** may be disposed between the stop lamp portions **3**. For example, the image lamp portion **4** may be disposed between the second light sources **700** of the stop lamp portions **3**.

The stop lamp portion **4** may include the second printed circuit board **600**, a third light source **800** disposed on the second printed circuit board **600**, and a pattern member **900** disposed on an optical path of the third light source **800**.

The pattern member **900** images light emitted from the third light source **800**. That is, the pattern member **900** images the light emitted from the third light source **800** to modify a shape of the light.

Accordingly, an optical pattern for a variety of shapes of light being imaged may be implemented in the image lamp portion **4**. As an example, the optical pattern may be implemented in a form in which a minute slit pattern is formed in a sheet having a reflective material such that a part of light is transmitted through the slit pattern. Otherwise, a part of light is transmitted by forming a shape of the optical pattern using a partially transmittable material such that the shape of light may be diversified.

Accordingly, the lighting device **1** may further perform a function of an image lamp.

Meanwhile, the stop lamp portion **3** and the image lamp portion **4** are exemplarily formed using one second printed circuit board **600** but are not limited thereto.

Also, a second connector **1000** may be disposed below the second printed circuit board **600**.

The second connector **1000** may apply power to the second light source **700** or the third light source **800**.

Taken together, the lighting device **1** may implement a clear light image by securing light uniformity using the guide portion **140**.

Also, the lighting device **1** may implement a three-dimensional effective light image through light with secured light uniformity using the half mirror member **200** and the mirror member **500**.

Here, since the lighting device **1** may use the half mirror member **200**, an image like a mirror may be implemented when the first light source portion **300** is not turned on and a three-dimensionally effective light image may be implemented when the first light source portion **300** is turned on.

Also, the lighting device **1** may implement a variety of light images by adjusting at least one of the height h and a width d of the guide portion **140**, the thickness t**2** of the diffusion plate **400**, and the thickness t**3** of the mirror member **500**.

For example, in a limit in the preset height H of the housing **100**, the three-dimensional effect of the light image may be adjusted by the second gap G**2** and the third gap G**3**. Also, since the second gap G**2** and the third gap G**3** are adjusted by the height h of the guide portion **140**, the thickness t**2** of the diffusion plate **400**, and the thickness t**3** of the mirror member **500**, the lighting device **1** may implement a variety of three-dimensional effects of a light image by adjusting at least one of the height h of the guide portion **140**, the thickness t**2** of the diffusion plate **400**, and the thickness t**3** of the mirror member **500**.

Here, since definition of the light image depends on light uniformity, the light uniformity may be adjusted by an air gap formed by the first gap G**1**. Also, the first gap G**1** may be adjusted by the height h of the guide portion **140**, the thickness t**1** of the first light source portion **300**, and the diffusion plate **400**.

That is, the height h of the guide portion **140** may be applied as common factors related to the three-dimensional effect and light uniformity of the light image.

Also, a size of the dark part formed by the second gap G**2** may be adjusted by the height h of the guide portion **140**.

Also, the separation distance d between the first light source portion **300** and the mirror member **500** may be determined by the width d of the guide portion **140**. Also, the separation distance d may have an effect on a reflection angle of light.

Accordingly, a size of the guide portion **140** provides criteria related to an arrangement of the first light source portion **300**, the diffusion plate **400**, and the mirror member **500** and may be a most significant factor in designing of the lighting device **1**. Accordingly, the guide portion **140** operates as a significant factor in aspects of a three-dimensional effect of the light image and the definition and light uniformity of the light image.

Here, the lighting device **1** may implement a clear light image while implementing a variety of light images using the guide portion **140**.

Meanwhile, since the lighting device **1** may further include the stop lamp portion **3** turned on by the brake being operated, the lighting device **1** may further perform a function of a stop lamp.

Also, the lighting device **1** may implement a variety of light images through the image lamp portion **4** including the pattern member **900**. Accordingly, the lighting device **1** may further improve a degree of freedom in design and aesthetics.

Although an exemplary embodiment of the present invention has been described above, it should be understood by one of ordinary skill in the art that a variety of modifications and a variety of changes may be made without departing from the concept and scope of the present invention which are defined in the following claims. Also, differences related to the modifications and applications will be interpreted as being included in the scope of the present invention defined by the attached claims.

DESCRIPTION OF REFERENCE NUMERALS

1: lighting device, **2**: tail lamp portion, **3**: stop lamp portion, **4**: image lamp portion, **100**: housing, **140**: guide portion, **200**: half mirror member, **300**: first light source portion, **400**: diffusion plate, **500**: mirror member, **600**: substrate, **700**: second light source, **800**: third light source, **900**: pattern member

The invention claimed is:

1. A lighting device comprising:
- a housing with an opening formed therein;
- a half mirror member disposed in the opening;
- a first light source portion configured to emit light toward the half mirror member;
- a mirror member configured to reflect light reflected by the half mirror member;
- a diffusion plate disposed between the first light source portion and the half mirror member; and
- a guide portion integrated with a bottom surface of the housing, and protruding from the bottom surface of the housing, the guide portion configured to distinguish the bottom surface of the housing into a first bottom surface and a second bottom surface,
- wherein the housing comprises a first area and a second area which are formed by the guide portion,
- wherein the first light source portion is disposed in the first area and is disposed on the first bottom surface, and the mirror member is disposed in the second area and is disposed on the second bottom surface, and
- wherein the diffusion plate is supported by the guide portion.

2. The lighting device of claim **1**, wherein the guide portion is formed to protrude from the bottom surface, in a first direction, to a certain height (h) above the bottom surface, and the first light source portion and the mirror member are arranged to be spaced at a certain distance d apart due to the guide portion.

3. The lighting device of claim **2**, wherein a light emission surface of the first light source portion is disposed to be spaced at a first gap G**1** apart from the diffusion plate, in the first direction.

4. The lighting device of claim **3**, wherein the first light source portion is formed to have a certain thickness t**1** in the first direction, and the first gap G**1** is adjusted according to the thickness t**1** of the first light source portion.

5. The lighting device of claim **4**, wherein the diffusion plate is disposed to be spaced at a certain second gap G**2** apart from a bottom surface of the half mirror member in the first direction.

6. The lighting device of claim **5**, wherein the diffusion plate is formed to have a certain thickness t**2** in the first direction, and the second gap G**2** is adjusted according to the thickness t**2** of the diffusion plate.

7. The lighting device of claim **5**, wherein the second gap G**2** is greater than the first gap G**1**.

8. The lighting device of claim **1**, wherein a reflective surface of the mirror member is disposed to be spaced at a certain third gap G**3** apart from a bottom surface of the half mirror member in the first direction.

9. The lighting device of claim **8**, wherein the mirror member is formed to have a certain thickness t**3** in the first direction, and the third gap G**3** is adjusted according to the thickness t**3** of the mirror member in the first direction.

10. The lighting device of claim **9**, wherein the reflective surface of the mirror member is disposed to form a certain height difference h**1** from a top surface of the diffusion plate while being disposed to be lower than the top surface of the diffusion plate.

11. The lighting device of claim **10**, wherein the reflective surface of the mirror member is disposed to form a certain height difference h**2** from a light emission surface of the light source portion.

12. The lighting device of claim **11**, wherein the reflective surface of the mirror member is disposed to be inclined at a certain angle θ on the basis of the light emission surface of the light source portion.

13. The lighting device of claim **1**, further comprising a stop lamp portion disposed in the housing,

wherein the stop lamp portion comprises a second printed circuit board and second light sources disposed on the second printed circuit board, and

wherein the second light sources are turned on by a brake of a vehicle being operated.

14. The lighting device of claim **13**, further comprising a third light source disposed on the second printed circuit board and a pattern member disposed on an optical path of the third light source,

wherein the pattern member modifies a shape of light emitted from the third light source.

15. The lighting device of claim **13**, further comprising an image lamp portion disposed between the second light sources of the stop lamp portion.

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